Report of the Haffkine Institute

for the Year 1925

by

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Corrigenda.

Page 2, 2nd line, *for* ' Shansher ' *read* ' Shamsher '.

„ 9, para. 2, line 4, *for* ' 6-2 ' *read* ' 6·2 '.

„ 11, under Anti-rabic Section, para. 3, line 3, *add* ' and ' after the word ' treatment,'.

„ 11, under Anti-rabic Section, para. 4, *for* ' (Table A) ' *read* ' (Table XVII) '.

„ 12, under *Schistosomiasis*, line 8, *for* ' moluses ' *read* ' molusces '.

„ 17, under The Anaemias of Pregnancy, para. 3, line 2, *for* ' attached ' *read* ' attacked '.

„ 18, line 13 from bottom, *for* ' rabits ' *read* ' rabbits '.

„ 24, line 2, *for* ' intravention ' *read* ' intervention '.

REPORT OF THE HAFFKINE INSTITUTE FOR THE YEAR 1925

STAFF.

Director.

Lt.-Col. F. P. Mackie, O.B.E., M.D., M.Sc., F.R.C.S., F.R.C.P., I.M.S., on leave from 11th April 1925.

Assistant Directors.

Major J. Morison, M.B., D.P.H., I.M.S., Acting Director from 20th June 1925 to 31st December 1925.

Captain R. H. Malone, M.D., I.M.S., on leave. Acted as Director from 11th April 1925 to 19th June 1925.

Dr. S. N. Gore, L.M. & S.

Dr. K. S. Mhaskar, M.A., B.Sc., M.D., D.P.H., D.T.M. & H.

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Rev. Father Caius, S.J., F.L.S., M.S., C.I.

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Mr. M. A. Malandkar, M.A., M.Sc.

Mr. S. K. Gokhale, B.A., M.Sc., A.I.Sc., from 26th January 1925 to 31st December 1925.

Anti-rabic Department.

Assistant Surgeon H. M. La Frenais, I.M.D.

Mr. R. K. Gokhale, S.M.S., from 20th November 1925 to 31st December 1925.

Special Research Officers.

Dr. Margaret Balfour, C.B.E., M.D.

Dr. N. H. Fairley, O.B.E., M.D., M.R.C.P., D.T.M. & H., on leave from 16th August 1925.

Dr. Agnes Murphy, W.M.S.

Dr. B. P. B. Naidu, M.D. (Edin.), M.Hy., D.P.H., D.T.M. (L'pool).

Medical and Scientific Assistants.

Khan Bahadur C. R. Avari, B.M.S. (General Diagnostic Department).

Mr. G. D. Chitre, L.M. & S., B.M.S. (Sprue and Plague Research).

Mr. N. P. Dalal, M.B., B.S., B.M.S. (Plague Vaccine Department).

Jemadar Shansher Jang, I.M.D. (Plague Research), from 3rd October 1925 to 31st December 1925.

Mr. T. G. Akula, S.M.S. (Morbid Histology and Malaria).

Jemadar F. Jasudasan, I.M.D. (Bilharziosis and Sprue).

Mr. K. H. Bharucha, B.A., B.Sc. (Public Health Chemistry).

Chief Technical Assistants.

Mr. A. Petty—(Plague Vaccine).

„ J. Petty—(do.)

„ J. Mallett—(do.)

„ F. R. Mistri—Head Clerk.

„ G. G. Subnis—Accountant.

„ R. D. Panwalkar A.M.—Artist and Photographer.

„ S. V. Nadkarni—Storekeeper.

„ S. R. Rajadhyax—Packing.

„ H. J. Parelkar—Engineer.

„ P. C. Pavri—Electrician.

„ Shaik Mahomedalli—Senior Media Maker.

Junior staff, subordinates and menials numbering 121.

Change of Name.

On 14th August 1925 the name of "Haffkine Institute" was bestowed on this Laboratory by the Government of Bombay in place of the former name of Bombay Bacteriological Laboratory. This change of name is a tardy, but none the less, whole-hearted recognition of the great bacteriologist who came to India when plague broke out in 1896, and, overcoming many obstacles, devised and prepared the prophylactic vaccine which to this day holds first place among practical measures against plague. The change of name is also apposite, for in its activities the Institute has outgrown its former name.

Manufacture and distribution of the plague prophylactic.

In spite of the decrease in plague throughout India, the demand for Haffkine's plague prophylactic continues. There seems to be no doubt that, in spite of the severity of the reaction which the vaccine is apt to induce, the vaccine is gaining in popularity. In the Punjab we were informed that a riot nearly followed an exhausation of the local supply of vaccine. Formerly the inoculator had to exercise considerable tact to induce a village population to submit to vaccination against plague.

From the opening of the Laboratory up to the end of the year 1925 nearly 26 million doses of the vaccine have been sent out. The output in each of the last five years has been :—

Year.	Number of doses.
1921	823,230
1922	972,037
1923	1,298,415
1924	1,489,734
1925	1,027,071

The distribution of anti-plague vaccine in India and foreign countries during the last two years is shown below :—

(Figures represent the number of doses.)

Place or Province.	1924.	1925.
Bombay Presidency ...	91,980	111,226
Madras Presidency ...	79,534	56,736
Bengal, Bihar and Assam ...	35,575	29,031
United Provinces of Agra and Oudh	112,790	125,573
The Punjab	482,839	303,292
North-West Frontier Province	75,363	3,501
Central Provinces and Berar.	101,586	45,269
Burma	97,482	100,012
Native States in India ...	329,934	241,902
Countries outside India ...	81,745	10,529
Portuguese territory in India	906	...
Total number of doses ...	1,489,734	1,027,071

The following table shows the number of doses of anti-plague vaccine despatched monthly during the past two years :—

Month.	1924.	1925.
January	177,011	160,734
February	193,434	179,934
March	190,482	142,612
April	261,352	78,173
May	97,779	12,788
June	33,911	3,225
July	15,779	21,347
August	39,400	56,578
September	162,800	99,890

Month.	1924.	1925.
October	129,500	77,917
November	84,550	92,685
December	103,736	101,188
Total ...	1,489,734	1,027,071

Six hundred and forty-two thousand three hundred and seventy rats alive and dead were sent by the Bombay Municipality to the Institute for examination for plague. This important work enables the Municipal Health Department to get warning of an outbreak of plague and, as the locality whence each rat came is known, the locality where plague may be expected is foreshadowed.

As we understand these examinations are the largest of the kind in any city in the world, and Bombay in this respect is frequently quoted as a model, the results and their relation to plague in the city are given in the following two tables:—

Examination of Rats for Plague in the City of Bombay, 1925.

Month.	Alive.	Dead.	Total.	Putrid.	Dead rats examined.	Plague infected.	Rattus Norwegicus.	Rattus rattus.	Working days.
January	21,491	40,598	62,089	2,920	30,652	93	88	5	26
February	17,478	36,025	53,503	2,446	27,192	273	260	13	23
March	16,681	36,738	53,419	3,585	25,140	477	457	20	24
April	15,561	36,576	52,137	3,597	24,417	441	418	23	23
May	12,928	36,299	49,327	4,247	26,100	360	343	17	26
June	13,043	31,749	44,792	3,358	22,106	177	160	17	24
July	13,143	35,123	48,266	3,434	26,122	112	96	16	26
August	13,720	34,329	48,049	3,039	22,203	102	82	20	23
September	20,222	41,031	61,253	3,791	29,322	86	75	11	24
October	20,228	40,129	60,357	4,515	28,201	82	67	15	25
November	16,502	36,821	53,323	4,000	25,427	53	50	3	24
December	16,273	39,582	55,855	3,352	28,303	62	56	6	25
Total ...	197,270	445,100	642,370	42,284	315,185	2,318	2,152	166	293

Relation of Deaths from Plague to Plague among Rats.

Period (1925).	Human plague; number of deaths.	Total number of rats examined.	Plague infected rats.	Percentage.	Plague infected Rattus rattus.	Plague infected Rattus norwegicus.
1st to 15th January	1	14,475	24	0·2	1	23
16th to 31st January	0	16,177	69	0·4	4	65
1st to 15th February	2	14,911	120	0·8	6	114
16th to 28th February	3	12,281	153	1·2	7	146
1st to 15th March	11	11,387	218	1·9	10	208
16th to 31st March	18	13,753	259	1·9	10	249
1st to 15th April	8	12,217	222	1·8	10	212
16th to 30th April	21	12,200	219	1·8	13	206
1st to 15th May	15	13,907	234	1·7	13	221
16th to 31st May	15	12,193	126	1·0	4	122
1st to 15th June	4	11,817	116	1·0	6	110
16th to 30th June	9	10,289	61	0·6	11	50

1st to 15th July	1	11,890	51	0·4	6	45
16th to 31st July	1	14,232	61	0·4	10	51
1st to 15th August	3	9,344	46	0·5	9	37
16th to 31st August	5	12,859	56	0·4	11	45
1st to 15th September	1	12,528	42	0·3	6	36
16th to 30th September	0	16,794	44	0·3	5	39
1st to 15th October	0	14,651	45	0·3	9	36
16th to 31st October	1	13,550	37	0·3	6	31
1st to 15th November	0	12,689	29	0·2	2	27
16th to 30th November	0	12,788	24	0·2	1	23
1st to 15th December	1	14,656	30	0·2	3	27
16th to 31st December	0	13,647	32	0·2	3	29
Total ...	120	315,185	2,318	0·73	166	2,152

Improvement of anti-plague vaccine.

Throughout the year researches on methods for improving the anti-plague vaccine, begun in 1923, have been continued by Dr. Naidu and Khan Bahadur Dr. C. R. Avari. Using 0·003 milligrams of the spleen of a rat killed by plague, they found this dose sufficient to kill 95 per cent. of rats subjected to it. On the other hand, if the rats had been protected by a dose (0·5 c.c.) of Haffkine's prophylactic, the average mortality fell to 62 per cent.

It will be recalled that the broth from which the vaccine is made is prepared by digesting goats' flesh with hydrochloric acid and neutralising the product with caustic soda. The procedure is carefully controlled and the resulting broths are, as nearly as possible, uniform. The germ used is derived from a case of plague in man, and is of such a virulence that it will kill a rat in four days. These are the methods used to insure a high standard of vaccine. An examination of 28 brews which gave an average of 62 per cent. mortality, showed also that 18 brews were better than average, and of the remainder all but two were within 9 per cent. of the average. Two brews were found in which the mortality of the rats protected with these brews and tested with the standard infecting dose rose to 86 per cent. Such brews are inefficient and their discovery led to the examination of all brews by testing them on rats before they are issued, and the rejection of brews which give a low grade of immunity. Pending an elucidation of the cause of such occasional variations, the standardisation of all brews by testing them first on rats is a notable advance.

A series of experiments showed that the vaccine is at its best when used within six months of its manufacture, but is hardly less efficient during the following six months, and it is still potent up to 18 months from the date of its manufacture. A virulent strain of B. pestis has always been used and the importance of using a virulent strain of the plague bacillus was shown by one experiment in which for experimental purposes a vaccine was prepared from a five years' old culture of B. pestis. This culture had lost its virulence and the vaccine prepared in the usual way from it gave less than half the immunity given by a vaccine prepared from the same culture after its virulence had been raised by passage through a series of rats.

Two years ago we showed that the prophylactic principle or antigen of the vaccine was contained in the supernatant fluid and not, to any considerable extent, in the sediment. This year it has been shown that the supernatant fluid is much more toxic to rats than the sediment, but less toxic than the whole vaccine. These differences in the toxicity to rats of the supernatant fluid and the sediment seem to be related to the reaction produced in man by the corresponding fractions of the vaccines. Among 100 volunteers divided into four groups, the whole prophylactic produced the greatest reaction; the supernatant fluid less; the sediment still less; and the broth medium alone, little or none.

Over twenty years ago Haffkine attempted enriching the vaccine by adding plague bacilli grown on agar to the ordinary broth vaccine after the latter had been incubated for its full period. Experiments on 320 rats show that this enrichment materially increases the efficiency of the vaccine without increasing its toxicity. With this method, however, there is a possibility of introducing a contamination, and the advantage gained may not balance such a risk.

Bouillon made from caesin gave a vaccine of high protective value, and its use is under consideration. The addition of glucose to a bouillon makes the resulting vaccine useless. Experiments with bouillons having pH values from 6·2 to 7·2 showed that 6·8 is the best initial pH value for the bouillon. Buffering the same bouillons with acid phosphate of soda, with a view to reducing the rate at which the pH changes with the growth of the bacillus pestis, does not produce a better vaccine than that yielded by the unbuffered bouillon.

Attempts to render plague vaccine less toxic and of greater immunising value by mixing it with immune plague sera were made by Shiga in 1900; by Besredka in 1902; and by Gosio in 1905; all claiming degrees of success. Rowland (1912), experimenting with rats did not confirm their results, but Kitano and Seekegawa (1918) obtained similar results to Besredka. Recently (1924), Major Stoker believed he made a plague vaccine atoxic by sensitising it with an immune serum. In this Institute, during the last year, sensitised vaccines have been prepared by treating the growth from an agar culture of the plague bacillus with anti-plague sera derived from rabbits and sheep and a horse serum kindly sent to us by the Director of the Pasteur Institute in Paris. Using these sensitised vaccines on rats, the results show that they are not superior to a control series treated with unsensitised vaccine, nor to a series treated with Haffkine's prophylactic.

Mercurochrome.

Mercurochrome was suggested by Dr. Andrew Balfour for the treatment of plague; and in 1925 he reported that he had received accounts of a few cases of plague in which the drug had been distinctly beneficial. Mercurochrome in a dilution of 1 in 3,200 will kill the plague bacillus in 15 minutes. Rats weighing from 70 to 100 grammes apparently stand doses up to 10 milligrammes, but doses of 15 and 20 milligrammes are lethal. Rabbits weighing from 1,920 to 2,360 grammes stand doses up to 20 milligrammes, but succumb to 30 milligrammes, 40 and 50 milligrammes. Rabbits seem to stand repeated doses, if these are moderate. As much as 72·5 grammes of mercurochrome has been given in nine days without apparent ill effect. In experiments in which 282 rats and 60 rabbits with suitable controls were used, it was found that the drug had no influence on the course of the disease. The details will be found in the paper by Dr. Naidu to be published in the Journal of Medical Research.

Transmission of plague by fleas.

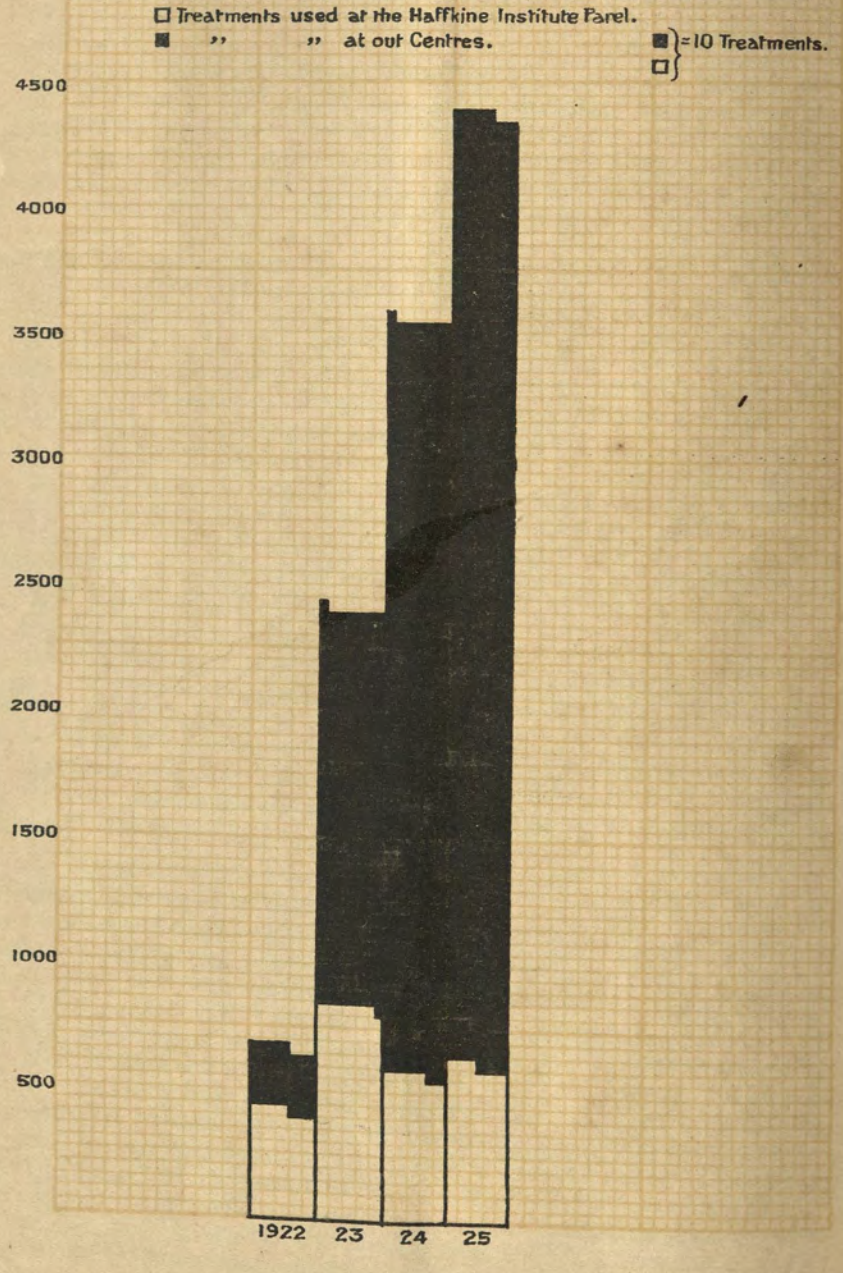
An investigation into the transmission of plague by the fleas *Xenopsylla cheopis* and *X. astia* was resumed and is still being continued. The identification of fleas is carried out by the technique introduced by Major Taylor. By this technique the flea to be examined is dropped into the wide end of a Wright's pipette and is blown into the narrow stem headdown. It thus remains fixed in a position suitable for microscopical examination and, when the examination is complete, the flea can be blown back into a test tube uninjured and ready for use. The method is as excellent as it is simple, but in some cases it is impossible accurately to diagnose a sub-species. It will be recalled that female fleas of *X. cheopis*, *X. astia* and *X. brasilensis* are identified by the shape of the spermotheca which contains dark coloured matter. In some very young fleas Dr. Chitre notes that the black matter is absent and in its absence the shape of this organ cannot be accurately determined. In other cases the spermotheca which ordinarily lies antero-posteriorly on the flea is placed obliquely when its shape is optically distorted. The spermotheca may also be displaced by the distension of the lower part of the gut with digested blood. In the males it may be recalled that the 9th sternite which is club shaped in the X. cheopis and flat or sickle shaped in X. astia, is of importance in determining the species. Occasionally this part is difficult to see, often it is overlapped by adjoining portion of body. In doing the transmission experiments it is important to reject all fleas which are not confidently distinguished as belonging to one or other species.

Another important fallacy in this work is due to the difficulty in completely ridding rats of fleas. In a previous investigation this was done by lightly chloroforming the rat and brushing off the fleas. Dr. Chitre found that this method could not be relied on to remove more than 60 per cent. of the fleas, and it has been superseded by momentarily dipping the rat in petrol. This method has been thoroughly successful in completely ridding a rat of fleas without apparent injury to the rat itself.

The transmission experiments were begun in September. Up till December the successful transmissions were few. It is possible that the season has something to do with the failures. Bombay generally is free of plague during these months and Dr. Chitre noted that between September and December the multiplication of bacilli inside the stomach of fleas was poor and the rats infected did not develop the usual intense septicaemia. X. astia, which is apparently less common in Bombay and in Madras, could not always be found in sufficient numbers to take their part in a transmission experiment. Out of an aggregate of 30 experiments carried on up to the end of the year, 9 had to be discontinued for want of fleas and 15 more had to be cancelled for various reasons which interfered with the accuracy of the experiment. In the remaining six, in which the results were strictly comparable, not a single transmission took place with cheopis and none with astia.

TOTAL NUMBER OF ANTIRABIC TREATMENTS USED
AT THE HAFFKINE INSTITUTE PAREL, AND AT OUT CENTRES DURING THE YEARS.

1922. 1923. 1924. 1925.



This may give some idea of the difficulty of carrying out accurate transmission experiments. Subsequent progress has been more rapid and will be dealt with in next year's report.

Anti-rabic Section.

The Anti-rabic Section in the fourth year of its existence continued to develop. As in previous years it has been the endeavour to encourage treatment in districts nearer to the homes of persons bitten. We thus provide treatment for many persons who would otherwise be unable to take the long journey to Bombay, Kasauli or Coonoor.

During the past year 4,381 persons received anti-rabic treatment from this Institute of which 625 were treated at Bombay these being mostly persons living within access of this City. The remaining 3,756 were distributed to 30 different centres of which 13 are under the Government of Bombay and 17 are in the Central Provinces, United Provinces, Baluchistan, Indian States, the Army Department, and one or other of the great railways, and Goa.

The statistics of the 625 treated at Bombay are shown in detail in the appended tables. Of these, one patient died within less than fifteen days after the completion of treatment, five died more than fifteen days after the completion of treatment. The latter classed as failures gives a failure rate of 0·96 per cent.

The statistics of the 3,756 persons who were treated at out-centres are incomplete (Table A). We know, however, that among these four died during treatment; six within fifteen days of treatment; and eighteen more than fifteen days after the completion of treatment. Each person treated was asked to report after three months. Only 762 reports were received. These included the twenty-eight fatal cases and it is almost certain that where no report was received the case was well. If this be the case the failure rate among those treated at out-centres was 0·48 per cent.

Two years ago a reference was made in this report to an intravenous method of treatment. This is reserved for cases bitten severely by animals proved to be rabid by finding Negri bodies in the brain, or judged to be almost certainly rabid by their behaviour and hence considered to be at great risk. Only six cases were treated during 1925 and none of these contracted hydrophobia.

From 1923 to the end of 1925, 191 patients were treated intravenously with anti-rabic vaccine. Out of fourteen injections, they received from one to eight intravenously and the remainder subcutaneously in the usual way. Among these, two patients arriving twenty-four days and nine days late, respectively, died of hydrophobia during their course of treatment and eight died of hydrophobia more than fifteen days after the treatment. When treatment was first begun one to three injections were given intravenously; later the number was raised to five intravenous injections;

and still later to seven. The following table shows the distribution of the deaths among these cases :—

No. of intravenous injections.	Cases treated.	Deaths.
1	26	1
2	6	2
3	36	2
4	10	1
5	61	1
6	4	0
7	47	3
8	1	0

It will be noted that among 78 cases receiving one to four intravenous doses there were six deaths, giving a mortality of 7·7 per cent.; whereas among 113 cases receiving five to eight doses there were four deaths, giving a mortality of 3·5 per cent.

The brains of 125 dogs in Bombay City or in the adjoining suburb of Bandra were received for examination. Of these 3 were received in a condition unfit for examination, in 43 no evidence of rabies was found, while Negri bodies were present in 79. This is a serious menace in a city like Bombay. Moreover, Bombay being an island, it should be possible to get rid of this menace by more active measures.

One hundred and four dogs' brains were received from out-stations. Of these nine were unfit for examination; in 28 no evidence of rabies was found, and 67 were proved to be rabid.

Schistosomiasis.

Dr. Hamilton Fairley continued his study of the pathology of *Schistosomum spindalis*. This is a small parasitic worm which was first found in mesenteric vessels of two cows (*Bos indicus*) at Muktesar in 1906. It was also described in Sumatra about the same time by Vryberg. Liston and Soparkar in 1918 when investigating at this Laboratory the possibilities of the spread of human Schistosomiasis in India found fork-tailed cercaria in one of the fresh water moluses, *Planorbis exustus*, met with in Bombay. They successfully transmitted an infection to guineapigs and recovered adult worms when the guineapigs died. Later they infected a young kid, and at *post mortem* numerous worms in all stages of development were found in the liver, and the portal veins were literally packed with worms containing the characteristic ova. Dr. Hamilton Fairley elaborated these observations and has written an exhaustive paper on the pathology of *Schistosomum spindalis*.

Briefly, animals are infected in the neighbourhood of Bombay from November to April. If during this season snails are collected and placed in test tubes to which about 10 c.c. of water has been added, forked-tailed cercaria of *S. spindalis* can be seen in the water and can be filtered off with filter paper and rewashed back into a known volume of water. A given volume of water in which a known number of cercaria are present is then applied to the skin of an animal. After 10 to 20 minutes only the tails of the cercaria remain in the water, and the skin when examined microscopically shows the invasion that has occurred. When an animal dies from the infection of *S. spindalis*, the characteristic features are the presence of Schistosomes and thrombosis in the portal or mesenteric vein, and changes in the liver varying from small whitish tubercles to an advanced periportal cirrhosis. If the animal has been treated with tartar emetic, only male worms survive and the surviving females have comparatively few ova. Dr. Fairley found that quite apart from treatment, the ova in the tissues are continually dying and becoming converted into shrunken, blackened spindles with dark amorphous contents. Dr. Fairley's work shows that from the standpoint of comparative pathology *S. spindalis* which is found in goats and cattle in India is closely allied to *S. mansoni*, the cause of human intestinal Schistosomiasis in Africa, and *S. japonicum*, the Schistasomiasis found in the Far East. In all three the adult worms are chiefly found in the portal and mesenteric veins with the largest number of eggs deposited in the enterocolon and the liver. On the other hand in *S. hæmatobium* the worms inhabit veins of the pelvis and the ova are deposited in the bladder and ureters.

Bilharzial papillomatosis frequently observed in *S. mansoni* and *S. japonica* has never been demonstrated with the ova of S. spindalis which are probably nonirritative. A full account of this work is being published by Dr. Fairley and Lieut.-Colonel Mackie.

Chemical Department.

Thirty-three samples of water were examined bacteriologically and 115 samples were examined chemically. After reviewing this work it is difficult to understand of what value these bacteriological analysis were to the senders. The samples are forwarded by post or by rail and arrive after many hours and often several days' delay. These samples as far as we can gather were all taken from supplies liable to pollution and for the third year in succession we desire to repeat Colonel Mackie's remarks. "The chemical and bacteriological examination of waters liable to pollution is useless and dangerous; useless because it is only of value as regards the particular sample analysed, and dangerous because it creates a sense of false security." The lesson we wish to drive home is that waters liable to pollution whether of wells, tanks or rivers, should be looked upon as dangerous, and should be treated by chlorination in an approved manner, or by boiling. If a water supply is chlorinated, then bacteriological tests of properly taken samples will show whether the chlorination is effective or not.

It seems to us it is time that some agreement were arrived at among public health authorities in this province on the subject of the reports on the potability of water supplies.

Detection of hydrogen sulphide, nitrites, and indole.

Dr. Gore has continued his work on intestinal bacteria, studying chiefly the production of indole, H_2S and nitrites. H_2S is detected by moistening the lower end of the cotton wool plug of the inoculated peptone solution with a few drops of a five per cent., aqueous solution of lead acetate, incubating the medium over-night, and examining the treated plug for browning or blackening as evidence of H_2S production. The production of nitrites is then ascertained by mixing a large loopful of the peptone culture with a similar loopful of Ilsovay's solution* placed on a white porcelain surface, when the presence of nitrites is evidenced by the mixture becoming pink within a few seconds. Lastly, for the detection of indole the upper end of the plug is moistened with potassium persulphate and paradimethyl benzal dehyde solutions, the plug reinserted in an inverted position and the tube heated in the water bath, when the presence of indole is indicated by the newly treated end of the plug becoming pink. The brand of peptone used is Baird and Tatlock's Bacto-peptone.

Dr. Gore has recently observed that B. pestis is one of the few Gram negative achromogenic ærobic bacilli which give a positive nitrite reaction.

Biochemical Section. Sprue.

The Biochemical Section during the early part of the year was engaged in the investigation of sprue. A thorough study of a series of sprue cases was carried out by Dr. Hamilton Fairley including the examination of blood, gastric contents by fractional meals, examination of stools, and several *post mortem* examinations.

Sprue seems to be primarily an inflammatory process involving a part or whole of the alimentary tract from the mouth to the rectum. The most notable changes are the well-known erosions on the tongue and the less familiar erosions in the small intestine. On the tongue there is thinning of the epithelial surface and a superficial invasion of the epithelial surface with yeast mycelia, but as this is unaccompanied by cellular reaction under the corium, it is not considered to have any etiological significance.

In the small intestine the most notable feature is thinning of the walls. It may be that this is merely an atrophy shared by other organs, but gaseous distension of the bowel is also a factor in its production.

The next most characteristic change is in the bone marrow. In one case maroon coloured marrow typical of pernicious anæmia filled the entire medullary canal and inter-trabecular spaces of the long bones. In another case there was hyperplasia of the red

* *Vide* Thresh. Water and Water Supplies, third edition, p. 563.

marrow which filled the head and half the shaft of the femur, the remainder of the medullary canal containing yellow marrow. Complete aplasia of the bone marrow was also met with. The whole marrow being a gelatinous, greenish yellow, except for one small spot of red marrow.

These changes are of great interest. For in sprue a transition from secondary anæmia with a low colour index to an anæmia of the pernicious type with high colour index has been met with. This case culminated in a severe blood crisis associated with diarrhoea and rapidly terminated in death.

There seems to be no doubt that sprue is a distinct clinical entity and that in its atypical form it is more wide-spread than is generally recognized. The early history of some of the hospital cases shows that these are frequently being admitted and re-admitted with debility and enteritis before a sore tongue or the passage of large frothy stools indicated that the condition was sprue. Sometimes the anæmia is of such an intensity that it overshadows the ulceration of the mouth and the intestinal symptoms. Emaciation is always a concomitant of sprue. The central nervous system is never involved. These two points help to distinguish the severe anæmia of sprue from pernicious anæmia.

Instances of several cases in the same family and among the staff of the same office have been noted. Certain bungalows and localities are believed to be associated with the disease. The outstanding predisposing factors in all serious cases were long residence in Bombay and preceding malaria, dysentery or both of these diseases. Sprue rarely develops in a healthy person. No instance of tetany has occurred in a consecutive series of fifty cases and œdema was noted in only three instances. Muscular cramps are frequent.

In a series of cases studied by the fractional test meal method, four cases showed hyperchlorhydria, seven were within normal limits, in eight there was hypochlorhydria, and in seven free hydrochloric acid was completely absent.

In almost all our cases there was much tenacious mucus in the stomach. Most showed delayed emptying of the stomach. Hypoacidity or actual achlorhydria was found in more than half of the cases.

Active HCl in the stomach is the sum of the free HCl and HCl combined with protein and it is calculated by subtracting the inorganic from the total chloride readings. The results of a study of the fractional test meals showed that there was a satisfactory total chloride curve in cases of hypochlorhydria. This meant that the function of the stomach was not in abeyance. The decreased acidity was found to be due to neutralization by regurgitated duodenal contents. It looks as if the stomach developed an intolerance for HCl.

The majority of sprue cases develop anaemia if the disease is at all far advanced; but cases are met with in which this condition

has not occurred. The colour index is like that of pernicious anaemia. The higher the colour index the more serious the condition. Nucleated red cells, especially megaloblasts, are rarely seen.

Van den Berg's reaction for bile pigment in the blood commonly occurs in pernicious anaemia, whereas it is not common in sprue. This is probably of importance in differentiating this disease.

The high fat content of sprue stools is a feature of the analyses and it is possible that it is related to an over-excretion of fat and not to its deficient absorption. In the blood analyses, for the complete results of which the reader must be referred to a paper about to be published by Lieutenant Colonel Mackie and Dr. Hamilton Fairley, the most interesting point is that they confirm the fall in ionic calcium which Scott looked upon as characteristic of the disease. At the same time the therapeutic results of the use of calcium and parathyroid have been disappointing.

On the termination of the sprue enquiry, Major S. S. Sokhey was appointed to the charge of the Biochemical Unit and took up the chemical aspects of the growth of plague in broth media.

Researches into the buffering of media are also being carried out. but so far no definitely useful information had been obtained, Apparently buffering has no effect on the antigenic properties of plague vaccine when this is tested on rats.

The Biochemical unit is now fully equipped and is able to undertake any of the more complex analyses of blood and urine and expired air necessary to modern medicine.

Pharmacological Unit.

The Pharmacological Unit has continued its work on the indigenous drugs.

Holarrhena antidysenterica.—The seeds of this plant yield 3 per cent. of a semidrying oil which contains (1) 12·2 per cent., of ricinoleic acid, (2) the alkaloid conessine to the extent of 0·025 per cent. The bark contains 0·22 per cent. alkaloid conessine and 9·56 per cent., of a gum whose chemical and physical properties are being determined.

Out of 41 cases of dysentery treated with the seeds, 24 improved. The period of treatment averaged 12 days. Of 75 cases treated with the bark, 59 improved within an average of 8 days. The gum from the bark seems to have the same effect as the powdered bark itself. The oil extracted from the seeds has a beneficial effect on symptoms of dysentery. It would appear, however, that the anti-diarrhoeal properties of this plant are not inherent in one chemical constituent in particular, but reside in a combination of two or more. Twelve cases infected with round worms were treated with 16 minims each of the oils from the seeds, but no worms were passed; 29 worms were obtained from these cases by other treatment. This result disposes of the so-called anthelmintic properties of the oil from Holarrhena anti-dysenterica.

Butea frondosa.—From a study of 10 cases the anthelmintic action of this drug seems to be associated with the alcohol-soluble portion of the residue.

Gymnema sylvestre.—The extracts from the leaves of this plant are mostly resinous and the determination of their nature may prove a matter of difficulty.

Nyctanthes arbor-tristis.—In doses of 20-60 grains of leaves, according to Dr. Mhaskar, were found to bring down the temperature to normal in all of 19 cases of malaria.

Varia.—This drug in stated to be the charred leaves of *Melia azadirachta* and was tried for leprosy at the request of a private person. It was ineffective.

Helminthiasis.—1,937 prisoners in the Umarkhadi Jail were examined for the presence of Helminthic infection. Hookworms were present in 46·6 per cent., round worms in 30·6 per cent., and whipworms in 67·8 per cent., Hookworm infection shows the following seasonal distribution :—

January	... ...	May	... 32·8	September	... 64·6
February	... 38·1	June	... 54·3	October	... 41·6
March	... 33·3	July	... 68·5	November	... 37·7
April	... 20·9	August	... 76·0	December	... 39·0

The Anaemias of Pregnancy.

Dr. Margaret Balfour, C.B.E., began an enquiry into the causes of maternal and infant mortality in India. In Bombay Dr. Balfour finds that an important cause of maternal mortality is a severe anaemia coming on during the last five months of pregnancy. The disease is a rare one in Europe. Among 12,000 labour cases treated in the Rotunda Hospital, Dublin, during the years 1920-1923, only one case of anaemia is recorded, and of 1,800 cases treated at Queen Charlotte's Hospital during 1922, only one case occurred. On the other hand, Major Green Armytage, I.M.S. of the Eden Hospital, Calcutta, has records of over 100 cases; and, in response to a questionnaire, cases have been reported from Delhi, the Punjab, Madras, Central India, Central Provinces, Sind, Bengal, and Baluchistan. Whether these are all of the same type and due to a similar cause, it is too soon to say. In Bombay, in five months Dr. Balfour studied sixty cases in three of the Bombay Maternity Hospitals.

The proportion of non-pregnant to pregnant women in Bombay City is about 25 to 1, but the incidence of cases of anaemia is 4 to 1. Anaemia is, therefore, much more frequent among the pregnant, and where it is present in a non-pregnant woman, there is usually some cause, such as tuberculosis, dysentery, or malaria. In pregnant cases, these causes are not usually found.

The majority of women stated that they had always been well, and gave a definite history of good health until the disease attached them. The proportion of primiparæ—one-third of the total—and the higher mortality (52 per cent.) among primiparæ among the whole

(40 per cent.) have been noted. Sixty-three per cent. of the children were still-born or died within a day or two of their birth. The constant symptoms are anaemia, swelling of the face, and oedema of the lower extremities; and frequent symptoms are vomiting (20 cases), albuminuria, haemic murmurs, occasionally there are sores on the tongue, diarrhoea, and slight enlargement of the spleen.

Malaria, which is so prevalent, offers an explanation for the frequency of this anaemia in India as compared with Europe and its prevalence in the latter half of the year. But most of the patients emphatically deny having had much fever and in only four out of 60 did the blood show parasites, even when there was fever at the time of the examination and quinine has not been administered. There is no increase in the mononuclears and the temperature charts do not usually show any tendency to periodicity.

In 84 cases examined by Dr. Murphy who is associated with Dr. Balfour in this investigation, the colour index averaged 1·05; the erythrocytes varied from 430,000 to 3,570,000 the average being 1,874,000. Variations in size were pronounced, the macrocytes being more numerous than the microcytes. Polychromatophilia was always present. Nucleated red blood corpuscles, usually megaloblasts, were frequent. Blood platelets are scarce. Leucocyte counts varied from 3,200 to 22,300, the average being 8,553 per c.m.m. The average differential count of 84 cases is:—

	Per cent.
Polymorphonuclears	67·9
Lymphocytes	23·2
Mononuclears	7·2
Eosinophiles	0·7

Deficiencies in diet may play a part, and it may be that the effects of a deficient diet become serious under the added strain of pregnancy. Evidence is being collected to elucidate this.

Dr. Agnes Murphy has repeatedly isolated a coliform bacillus from the urine in these cases, though there had been no symptoms indicative of an infection of the bladder. Dr. Murphy found this micro-organism fatal to rabits and recovered it from the spleen and the liver after death. In three out of seven cases, the patients' sera agglutinated the bacillus in 1 in 200.

New Yeasts.

Dr. A. D. Mihailova Emanuelov studied in detail two new yeasts which she had isolated from mineral springs at Essentuki, a health resort in the Caucasus Mountains. These were described at the meeting of the Indian Science Congress held in Bombay in January 1926 and were named *Saccharomyces essentukiensis* and *S. aureus essentukiensis*.

Blood Groups among Parsis.

Considerable attention has been given in recent years to the four blood groups that occur in the human family. These groups are

believed to be due to the presence or absence of two inheritable factors in the human blood. These factors (agglutinogens) have been called A and B (Hirschfelds). In Group I (Janski's classification) both factors are absent; in Group II only factor A is present; in Group III only factor B; and in Group IV both factors are present. Now in a group where factor A is present, the serum of the individuals of this group will agglutinate the red blood corpuscles of a group where factor B is present. Hence Group II which has only factor A will agglutinate the red blood corpuscles of individuals belonging to groups III and IV but will not agglutinate those individuals belonging to groups I and II. Similarly the serum from members of Group III will agglutinate the red blood corpuscles of members of Groups II and IV but not those of groups I and III.

Apart from the medicolegal use that can be made of this classification, the Group to which an individual belongs must be known if the individual should require by accident or illness, to be transfused with blood from another. It is dangerous to give a patient blood from an individual of an incompatible Group.

The blood groups of a race have, however, another interest. The Hirschfelds in 1919 published the blood Group distributions of individuals belonging to 16 nationalities whom they encountered in Serbia during the Great War; and they found that among European nations Group II, that is bloods having factor A alone, predominated, while among Asia-African nations, the Group III, or blood having factor B, were increased at the expense of Group II. Arabs, Turks, Russians and Jews formed an intermediate type. They suggested the distribution of these blood groups may throw light on the origins of different races and since then many examinations of the distribution of blood groups have been made all over the world.

Miss M. M. Mehta, D.Sc., has undertaken this among the Parsis of Bombay. One thousand persons, believed to be descendants of the original emigrants to India from Persia in the 7th century, were examined. No Iranis, or descendants of the Zoroastrians in Persia who were not among the original emigrants but have since come to India, and no children of a Parsi father by an *alien* mother (Juddins), were included.

The distribution among the four blood groups is as follows :—

Janski's Classification.

	Group I.	Group II.	Group III.	Group IV.
Parsis ...	37·9	20	35·7	6·4

The racial index or ratio of A/B is 0·63.

Miss Mehta has, however, made a further interesting observation: Among the Parsis the priests form a community the members of which until within the last thirty or forty years did not intermarry with members of the lay community. In three such unrelated families, the heads of the families on both the father and the

mothers' side and all their immediate progeny belong to Group I. Any descendants in the 3rd and 4th generations that do not belong to Group I, in so far as Dr. Mehta's investigation has gone, are the result of an intermarriage with a member of the lay community.

CLINICAL DIAGNOSIS, VACCINES, ETC.

(1) Wassermann examination (by Nogouchi's modification). The Sachs-Georgi method of diagnosis was carried out side by side with the Wassermann reaction.	Positive... 341		
	Negative . 811		
			1,152
Sachs-Georgi reaction ...	Positive... 291		
	Negative . 861		
			1,152
Formal-Gel ...	Positive... 108		
	Negative . 0		
			108
(2) Other routine diagnostic examinations...			2,037
(3) Autogenous vaccine prepared for cases...			259
(4) Pathological tissues for diagnosis—			
(*a*) Non-malignant ...	28		
(*b*) Malignant ...	65		
(*c*) Granulomata ...	18		
(*d*) Other pathological conditions ...	83		
			194
(5) Vaccines prepared (other than Haffkine's prophylactic and anti-rabic vaccine)—			
Mixed T.A.B. vaccine			4,680 c.c.
Cholera vaccine			2,825 c.c.
(6) Bacterial suspensions prepared for agglutination tests—			
Typhoid			225 c.c.
Paratyphoid A			275 c.c.
Paratyphoid B			275 c.c.
B. proteus			425 c.c.
Micrococcus melitensis			225 c.c.

(7) Stock cultures of bacteria—

368 stock cultures were subcultured at least once a month.

12 special cultures of B. pneumococci were subcultured on special media every four days.

(8) Bacterial suspensions and cultures supplied on indent—	
Bacterial suspensions (of various organisms)	451 c.c.
Cultures of various organisms ...	130

Fumigation.

This Institute has rendered assistance to the Customs authorities in the fumigation of imported cotton and plants, by means of Hydrocyanic acid gas.

I have much pleasure, on behalf of Lieut.-Colonel Mackie, Captain Malone, and myself, in acknowledging the loyal help we have had from the whole staff of the Institute. All have worked faithfully and assiduously and have contributed to this record of work.

J. MORISON,
Lieut.-Colonel, I.M.S.,
Acting Director, Haffkine Institute.

Parel, Bombay, 15th May 1926.

APPENDIX.

TABLE I.

Statistics for persons treated at Parel, 1922-1925.

Year.	Total treated.	Failures.		Deaths.		Indians.			Europeans.			Cases extracted, Advice cases and incomplete treatment.
		Total No.	Per cent.	Total No.	Per cent.	Treated.	Deaths.	Per cent.	Treated.	Deaths.	Per cent.	
1922 ...	429	4	0·93	4	0·93	365	4	1·09	64	...	...	212
1923 ...	845	9	1·06	10	1·18	730	10	1·37	115	...	...	523
1924 ...	587	7	1·19	10	1·70	525	9	1·71	62	1	1·61	513
1925 ...	625	5	0·8	6	0·96	583	6	1·02	42	...	...	355
Total ...	2,486	25	1·01	30	1·21	2,203	29	1·32	283	1	0·36	1,603

TABLE II.—EUROPEANS.

Classification according to number and depth of wounds and intervention of clothing and cauterization.

Deep.	Bare.	Uncauterized.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total.
+	+	+	...	...	1	1	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	3
+	+	−	...	1	1	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4
+	−	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
+	−	−	...	2	2	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5
−	+	+	12	2	3	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	18
−	+	−	...	3	3	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	7
−	−	+	...	2	..	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4
−	−	−	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Total ...			12	11	10	6	1	1	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	42 Cases Nil deaths.

TABLE III.—EUROPEANS.

Classified according to number of wounds and lateness of arrival.

Days late.	0	1	2	3	4	5	6	7	8	9	10	11	12	Total.
0 day ...	...	3	2	4	...	...	...	...	...	...	...	...	...	9
1 „ ...	3	2	3	1	1	1	...	...	...	...	...	...	...	11
2 days ...	2	1	2	1	...	...	...	...	...	...	...	...	...	6
3 „ ...	2	1	1	...	...	...	...	...	...	...	...	...	1	5
4 „ ...	1	1	...	...	...	...	...	...	...	...	...	...	...	2
5 „ ...	2	1	1	...	...	...	...	...	...	...	...	...	...	4
6 „ ...	2	...	1	...	...	...	...	...	...	...	...	...	...	3
7 „ ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
8–14 „ ...	...	1	...	...	...	...	...	...	...	...	...	...	...	1
15–21 „ ...	...	1	...	...	...	...	...	...	...	...	...	...	...	1
Total ...	12	11	10	6	1	1	...	...	...	...	...	...	1	42

TABLE IV.—EUROPEANS.

Classified according to position and depth of wounds and intervention of clothing.

Deep.	Bare.	Face.	Arm.	Trunk.	Leg.	Face and arm.	Face and leg.	Arm and leg.	Arm, face and leg.	Total.
+	+	...	3	...	5	...	...	1	...	9
+	–	...	...	...	5	...	...	...	...	5
–	+	3	16	...	4	...	...	1	...	24
–	–	...	...	1	3	...	...	...	...	4
Total ...		3	19	1	17	...	...	2	...	42

TABLE V.—INDIANS.

Classified according to number and depth of wounds, intravention of clothing and cauterization.

A.— Non-fatal and fatal cases.

Deep.	Bare.	Uncauterized.	0	1	2	3	4	5	6	7	8	9	10	11	12	Total.	Mortality %.
+	+	+	...	21	27	34	16	7	3	2	2	...	1	...	...	113	3·54
+	+	–	...	16	19	24	11	5	1	2	3	1	...	...	...	82	2·4
+	–	+	...	7	5	11	8	2	1	...	...	...	...	...	...	34	...
+	–	–	...	2	10	7	8	2	2	...	...	...	...	...	...	31	...
–	+	+	8	57	60	34	8	4	...	...	1	...	...	...	...	172	...
–	+	–	2	20	27	9	5	5	...	1	...	1	...	...	...	70	...
–	–	+	2	15	21	9	4	...	...	...	...	...	...	...	...	51	...
–	–	–	1	11	14	2	1	...	1	...	...	...	...	...	...	30	...
		Total ...	13	149	183	130	61	25	8	5	6	2	1	...	...	583	1·02

B.—Fatal cases.

Deep.	Bare.	Uncauterized.	0	1	2	3	4	5	6	7	8	9	10	11	12	Total.
+	+	+	...	...	...	2	...	1	...	1	...	...	...	...	...	4
+	+	–	...	1	...	...	...	...	...	...	1	...	...	...	...	2
		Total ...	...	1	...	2	...	1	...	1	1	...	...	...	...	6

TABLE VI.—INDIANS.

Classified according to number and position of wounds.

A.—Non-fatal and fatal cases.

—	0	1	2	3	4	5	6	7	8	9	10	11	12	Total.	Mortality %.
Leg	8	102	125	90	45	17	5	2	2	...	1	...	...	397	1·00
Trunk	...	4	6	3	1	...	...	...	...	...	...	...	...	14	.....
Arm	5	39	45	23	10	4	...	2	2	2	...	...	...	132	0·75
Face	...	4	4	6	1	...	1	...	...	...	...	...	...	16	.....
Multiple, leg and trunk.	...	...	...	1	...	...	...	...	1	...	...	...	...	2	.....
Leg and arm ...	...	...	3	5	2	2	1	...	1	...	...	...	...	14	.....
Leg, trunk and arm.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.....
Trunk and arm ...	...	...	...	1	1	...	...	...	...	...	...	...	...	2	.....
Multiple face, leg, arm and face, leg and face.	...	...	...	...	...	...	1	...	...	...	...	...	...	1	.....
Trunk and face ...	...	...	...	...	...	1	...	...	...	...	...	...	...	1	100
Arm and face ...	...	...	...	1	1	1	...	...	...	...	...	...	...	4	.....
Trunk, arm and face	...	...	...	...	...	...	...	1	...	...	...	...	...	...	.....
Total ...	13	149	183	130	61	25	8	5	6	2	1	...	...	583	1·02

B.—Fatal cases.

—	0	1	2	3	4	5	6	7	8	9	10	11	12	Total.
Leg ...	...	1	...	2	...	...	...	...	1	...	...	...	...	4
Arm ...	...	...	...	...	...	...	...	1	...	...	...	...	...	1
Trunk and face.	...	...	...	...	...	1	...	...	...	...	...	...	...	1
Total ...	...	1	...	2	...	1	...	1	1	...	...	...	...	6

TABLE VII.—INDIANS.

Classified according to number of wounds and lateness of arrival.

A.—Non-fatal and fatal cases.

Days.	0	1	2	3	4	5	6	7	8	9	10	11	12	Total.	Mortality %.
0 day ...	1	12	25	11	5	...	...	1	1	...	...	...	...	56	...
1 ,, ...	3	22	49	34	19	7	3	2	2	1	...	...	...	142	...
2 days ...	2	35	28	24	17	7	2	...	1	...	...	...	...	116	1·7
3 ,, ...	1	18	19	20	1	2	1	...	1	...	...	...	...	63	1·6
4 ,, ...	...	12	11	14	7	2	...	...	...	1	1	...	...	48	...
5 ,, ...	...	6	12	8	1	2	1	...	...	...	...	...	...	30	...
6 ,, ...	1	6	4	6	...	2	1	...	...	...	...	...	...	20	10
7 ,, ...	3	10	7	2	2	...	...	1	...	...	...	...	...	25	4
8—14 ,, ...	1	8	14	8	2	2	...	1	1	..	...	...	...	37	...
15—21 ,, ...	...	14	5	1	3	1	...	...	...	...		...	...	24	...
22—28 ,, ...	1	...	1	...	1	...	...	...	...	...	...	...	...	3	...
29—35 ,, ...	...	3	4	1	2	...	...	...	...	...	...	...	...	10	...
36—42 ,, ...	...	1	1	...	1	...	...	...	...	...	...	...	...	3	...
43—56 ,, ...	...	1	...	...	...	...	...	...	...	...	...	...	...	1	...
57—69 ,, ...	...	1	2	1	...	...	...	...	..	...	...	...	...	4	...
126 ,, ...	...	..	1	...	...	...	...	...	...	...	...	...	...	1	...
Total ...	13	149	183	130	61	25	8	5	6	2	1	...	...	583	1·02

B.—Fatal cases only.

Days.	0	1	2	3	4	5	6	7	8	9	10	11	12	Total.
2 days ...	...	1	...	...	...	...	...	...	1	...	...	...	...	2
3 ,, ...	...	...	...	1	...	...	...	...	...	...	...	...	...	1
6 ,, ...	...	...	...	1	...	1	...	...	...	...	...	...	...	2
7 ,, ...	...	...	...	...	...	...	...	1	...	...	...	...	...	1
Total ...	...	1	...	2	...	1	...	1	1	...	...	...	...	6

TABLE VIII.—INDIANS.

Classified according to position and depth of wounds and intervention of clothing.

A.—Non-fatal and fatal cases.

Deep.	Bare.	Leg.	Trunk.	Arm.	Face.	Multiple.	Multiple face.	Total.	Mortality %.
+	+	115	1	57	9	9	4	195	3·07
+	–	53	3	5	...	3	1	65	.....
–	+	164	3	63	7	4	1	242	.....
–	–	65	7	7	...	2	...	81	.....
	Total ...	397	14	132	16	18	6	583	1·02

B.—Fatal cases.

Deep.	Bare.	Leg.	Trunk.	Arm.	Face.	Multiple.	Multiple face.	Total.
+	+	4	1	1	...	...	...	6
	Total ...	4	1	1	...	...	...	6

TABLE IX.—INDIANS.

Classified according to position of wounds and lateness of arrival.

A.—Non-fatal and fatal cases.

Days.	Leg.	Trunk.	Arm.	Face.	Multiple.	Multiple face.	Total.	Mortality %.
0 day ...	32	2	17	2	2	1	56	.....
1 ,, ...	98	4	29	5	5	1	142	.....
2 days ...	82	4	21	2	6	1	116	1·7
3 ,, ...	45	2	12	2	2	...	63	1·6
4 ,, ...	33	...	12	3	...	...	48	.....
5 ,, ...	21	...	8	...	...	1	30	.....
6 ,, ...	14	1	4	...	...	1	20	10
7 ,, ...	16	...	9	...	...	...	25	4
8—14 ,, ...	28	...	6	1	2	...	37	.....
15—21 ,, ...	12	1	10	...	1	..	24	.....
22—28 ,, ...	2	...	1	...	...	...	3	.....
29—35 ,, ...	7	...	1	1	...	1	10	.....
36—42 ,, ...	3	...	...	...	...	...	3	.....
43—56 ,, ...	...	...	1	...	...	...	1	.....
57—69 ,, ...	4	...	...	...	...	...	4	.....
126 ,, ...	...	..	1	...	...	...	1	.....
Total ...	397	14	132	16	18	6	583	1·02

B.—Fatal cases only.

Days.	Leg.	Trunk.	Arm.	Face.	Multiple.	Multiple face.	Total.
2 days ...	2	...	..	...	...	.....	2
3 ,, ...	1	...	...	...	...	.....	1
6 ,, ...	1	...	...	...	...	1	2
7 ,, ...	...	...	1	...	....	.....	1
Total ...	4	...	1	...	...	1	6

TABLE X.

Statistical Table for all classes.

	Sub-class I.	Sub-class II.	Sub-class III.	Total.	Deaths.
	Bitten or licked on the head or face.	Bitten through the exposed skin or licked on any part of the body other than the head or face.	Bitten through the clothing.		
Class A.—Bitten or licked by animals proved rabid.	12	32	9	53	Nil.
Class B.—Bitten or licked by animals certified rabid.	.....	13	.....	3	1
Class C.—Bitten or licked by animals suspected rabid.	15	351	193	559	5
Total ...	27	396	202	625	6

European Statistical Table.

—	Sub-class I.	Sub-class II.	Sub-class III.	Total.	Deaths.
	Bitten or licked on the head or face.	Bitten through the exposed skin or licked on any part of the body other than the head or face.	Bitten through the clothing.		
Class A.—Bitten or licked by animals proved rabid.	3	4	1	8	Nil.
Class B.—Bitten or licked by animals certified rabid.	.....	.....	.....	.....	.....
Class C.—Bitten or licked by animals suspected rabid.	.....	25	9	34	Nil.
Total ...	3	29	10	42	Nil.

Indian Statistical Table.

—	Sub-class I.	Sub-class II.	Sub-class III.	Total.	Deaths.
	Bitten or licked on the head or face.	Bitten through the exposed skin or licked on any part of the body other than the head or face.	Bitten through the clothing.		
Class A.—Bitten or licked by animals proved rabid.	9	23	8	45	Nil.
Clas B.—Bitten or licked by animals certified rabid.	.....	13	.....	13	1
Class C.—Bitten or licked by animals suspected rabid.	15	326	184	525	5
Total ...	24	367	192	583	6

TABLE XI.

Cases developing hydrophobia during treatment, and within 15 days of completion of treatment.

Case No.	Sex.	Age.	Animal.	Number and position of the bite.	Whether on bare skin or through clothing.	Whether cauterized or not.
814	M.	5	Jackal ...	5, Trunk and face.	Bare ...	Uncauterized.

Date of commencing treatment.	Number of days late.	Duration of illness.	Interval between bite and death.	Remarks.
1-11-25 ...	6 days.	3 days.	35 days.	Within 15 days after completion of treatment.

TABLE XII.

Cases developing hydrophobia after 15 days of completion of treatment. "Failures."

Case No.	Sex.	Age.	Animal.	Number and position of the bite.	Whether on bare skin or through clothing.	Whether cauterized or not.
67	M.	7	Dog.	7, Arm.	Bare ...	Uncauterized.
220	M.	40	,,	2, Foot 1, Ankle.	,, ...	,,
229	M.	40	,,	1, Knee.	,, ...	,,
254	M.	22	,,	8, Calf. 3, Foot.	,, ...	,,
511	M.	6	,,	3, Ankle.	,, ...	,,

Date of commencing treatment.	Number of days late.	Duration of illness.	Interval between bite and death.	Remarks.
20-1-25 ...	7 days ...	2 days ...	53 days.	
9-3-25 ...	6 ,, ...	4 ,, ...	157 ,,	
14-3-25 ...	2 ,, ...	3 ,, ...	74 ,,	
23-3-25 ...	2 ,, ...	3 ,, ...	34 ,,	
12-6-25 ...	3 ,, ...	2 ,, ...	48 ,,	

TABLE XIII.

Showing the animals which bit, scratched or licked the patients.

Species of animal.	Number of persons bitten or scratched or licked.
Dog	527
Jackal	26
Cat	18
Monkey	7
Fox	2
Total ...	625

TABLE XIV.

Showing the number of persons who came for treatment each month during the year 1925.

Month.	Discontinued treatment.	Europeans		Indians	
		Treated cases.	Advice cases.	Treated cases.	Advice cases.
January	7	3	2	56	35
February	7	3	2	54	25
March	4	6	2	62	15
April	10	3	3	60	31
May	18	3	2	61	10
June	11	2	...	47	3
July	7	4	.....	45	9
August	13	5	2	40	13
September	6	2	1	43	9
October	12	2	4	38	11
November	7	6	6	37	16
December	7	3	3	40	42
Total ...	109	42	27	583	219
		Total ... 890			

TABLE XV.

The following table shows the classes of population from which patients were derived :—

1. British Army— Warrant Officers	2
2. Indian Army— Sepoys	1
3. European Civilians	40
Indian Civilians	582
Total ...	625

Of the European Civilians 7 were Government servants and of the Indian Civilians 29 were in Government employ.

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TABLE XVI.

Total number of patients treated at Parel according to provinces from which they came.

Province.	Europeans.	Indians.	Total.
Bombay City	37	465	502
Bombay Presidency	5	876	81
Central Provinces	.....	15	15
Goa	.....	10	10
Central India	.....	6	6
Indian States	.....	11	11
Total ...	42	583	625

TABLE XVII.

Statement of cases treated at different Centres during 1925.

Name of the place.	No. of persons for whom vaccine was issued.	No. of persons who received the full course of treatment.	No. of persons not fully treated.	No. of reports received from persons alive and well for at least three months.	Died during treatment.	Died less than 15 days after completion of treatment.	Died more than 15 days after completion of treatment.	No subsequent report received.
Ahmednagar ...	147	147	...	...	...	...	1	146
Belgaum ...	94	91	2	35	1	...	...	55
Ahmedabad ...	1,117	967	150	...	1	1	4	961
Karwar ...	1	1	...	1	...	...	...	...
Nasik ...	134	121	29	16	...	...	...	105
Jalgaon ...	91	73	18	...	...	...	...	73
Surat ...	157	121	36	28	2	...	3	88
Sholapur ...	20	15	9	6	...	...	1	8
Hyderabad (Sind).	12	12	...	1	...	...	...	11
Bombay (Byculla and Colaba).	269	253	16	253	...	...	...	...
Baroda ...	6	3	3	...	...	...	...	3
Hubli ...	23	23	...	23	...	...	...	...
Nagpur ...	724	669	55	31	...	1	3	634
Quetta ...	38	38	...	...	...	...	...	38
Poona ...	402	399	3	...	...	...	...	399
Mhow ...	29	29	...	29	...	...	...	...
Karachi ...	180	186	15	160	...	...	...	26
Jubbulpore ...	399	376	23	28	...	2	3	343
Rajkot ...	181	150	31	101	...	2	3	44
Jhansi ...	16	16	...	10	...	...	...	6
Nova Goa ...	69	66	3	40	...	...	...	26
Total ...	4,109	3,756	393	762	4	6	18	2,966

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